Energy Division
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Installation and Operating Manual
Switchboard Integra 1540, 1000, 0640, 0440 0340 & 0240 Digital Metering Systems

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Crompton
Switchboard Integra
Multifunctional metering for Three-phase Electrical Systems

Models 1540, 1000, 0640, 0440, 0340, 0240

Operating Instructions

Important safety information is contained in the seperate installation leaflet.
Installers must familarise themselves with this information before installation

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1 Introduction

This manual provides operating instructions for the Crompton Switchboard Integra series of Digital Metering Systems. Some versions of the Integra incorporate the metering transducer that provides the interface for the measurement of power supply parameters such as voltage, current, power, frequency etc. In other versions, the display and transducer are separate, interconnected units. The display allows the user to set up metering transducer parameters and to monitor the measurements. Some Integra models can be supplied as either an integral or display-only version, while others are only available in one format. This manual provides user instructions.

A separate leaflet provides installation instructions.

Table1 lists the various models of Integra and shows their distinctive characteristics.

Table 1 Summary of Integra models

Model	V	A	F	PF	kW	kWh	THD	Analogue	Serial	Pulse	Freq
0240	V		F								45-65 Hz
0340	V	A									45-65 Hz
0440	V	A	F								360-400 Hz
0640	V	A	F								45-65 Hz
1000	V	A	F	PF	kW	kWh			RS485 option	Pulse option	45-65 Hz
1540	V	A	F	PF	kW	kWh	THD	Analogue option*	RS485 option	Pulse option	45-65 Hz

* When used with an 1560/80 transducer that includes analogue options.

Voltage and current readings are true RMS, up to the 15th harmonic (31st for 1560/80 transducer).

The unit can be powered from an auxiliary a.c. or d.c. supply that is separate from the metered supply. Versions of each model are available to suit 100-250V 45-65 Hz a.c./d.c. and 12-48V d.c nominal supplies.

In this manual, the graphic

0240	0340	0440	0640	1000	1540

is used to show the models to which a screen applies. Boxes are greyed out to show models that do not have that type of screen.

0240	0340	0440	0640	1000	1540

This example indicates that the screen only applies to Models 1000 and 1540.

0240	0340	0440	0640	1000	1540	Option

This indicates that the screen is an option on models 1000 and 1540.

Important safety information is contained in the accompanying installation instructions. Installers must familarise themselves with this information before installation.

1.1 Unit Characteristics

Default display

1.1.1 0240

The 0240 will display the following parameters:

- System voltage (average of all phases)
- System frequency (Hz)
- Voltage line to neutral for each phase (4-wire systems only)
- Voltage line to line for each phase (calculated in 4-wire)

The 0240 has Set-up screens for potential transformer primary and secondary voltages.

Default display

1.1.2 0340

The 0340 will display the following parameters:

- System voltage (average of all phases)
- System current (average of all phases)
- Voltage line to neutral for each phase (4-wire systems only)
- Voltage line to line for each phase (calculated in 4-wire)
- Current in each line.

The 0340 has Set-up screens for:

- Full-scale current value
- Potential transformer primary and secondary voltages.

Default display

1.1.3 0440 and 0640

The 0440 operates on a mains frequency of 400 Hz nominal and the 0640 at 45-65 Hz. The units can measure and display the following parameters:

- System voltage (average of all phases)
- System current (average of all phases)
- System frequency (Hz)
- Voltage line to neutral for each phase (4-wire systems only)
- Voltage line to line for each phase (calculated in 4-wire)
- Current in each line

The 0440 and 0640 have Set-up screens for:

- Full-scale current value
- Potential transformer primary and secondary voltages.

Default display

1.1.4 1000

The 1000 will display the following parameters:

- System voltage (average of all phases)
- System current (average of all phases)
- System frequency (Hz)
- Voltage line to neutral for each phase (4-wire systems only)
- Voltage line to line for each phase (calculated in 4-wire)
- Current in each line
- Neutral current[1]
- Power Factor
- Active Power (kW)
- Reactive Power (kVAr)
- Apparent Power (kVA)
- Active Energy (kWh)[2]
- Reactive Energy (kVArh)[2]
- Total System Current Demand (AD)[2]
- Total System Active Power Demand (kWD)[2]
- Maximum Total System Current Demand (AD)[2]
- Maximum Total System Active Power Demand (kWD)[2]

The 1000 has Set-up screens for:

- Full-scale current value
- Potential transformer - primary voltages.
- Demand integration time and energy/demand resets
- Pulse output duration and rate divisor (option)
- RS485 serial Modbus parameters (option)

A pulsed relay output, indicating kWh, and an RS485 Modbus™ output are available as optional extras. The Modbus output option allows remote monitoring from a Modbus master.

[1]Neutral referenced parameters are only available when used with 4-wire and single phase configured transducers.

[2]All energy and demand measurements are importing only unless connected as exporting unit.

Default display

1.1.5 1540

The1540 is available either as a display unit operating in conjunction with a 15xx measurement transducer or as a self-contained unit incorporating a transducer. The unit can measure and display the following:

- System voltage (average of all phases)
- System current (average of all phases)
- System frequency (Hz)
- Voltage line to neutral for each phase (4-wire systems only)
- Voltage line to line for each phase (calculated in 4-wire)
- Current in each line.
- Neutral current[1]
- Power Factor
- Active Power (kW)[2]
- Reactive Power (kVAr)[2]
- Apparent Power (kVA)
- Active Energy (kWh)[2]
- Reactive Energy (kVArh)[2]
- Total System Current Demand (Admd)[2]
- Total System Active Power Demand (kWD)[2]
- Maximum Total System Current Demand (AD)[2]
- Maximum Total System Active Power Demand (kWD)[2]

The 1540 has Set-up screens for:

- Full-scale current value
- Potential transformer - primary and secondary voltages (Dis 1540 and Integra 15xx)
- Potential transformer - primary voltages (self contained)
- Demand integration time and energy/demand resets
- Pulse output duration and rate divisor (option)
- RS485 serial Modbus parameters (option)
- Analogue current output (option, with separate transducer only)

A pulsed relay output, indicating kWhr (and Kvarh on the two part Dis 1540 and Integra 15xx combination), and an RS485 Modbus™ output are available as optional extras. The Modbus output option allows remote monitoring from another display (not self contained) or a Modbus master.

The Analogue current output option provides a current output that indicates the value of a chosen parameter.

[1] Neutral referenced parameters are only available when used with 4-wire and single phase configured transducers.

[2] All energy and demand measurements are importing only unless connected as exporting unit.

1.2 Maximum Power

Products covered in this manual are limited to a maximum power of 360 MW. During set-up, primary voltage and current setting are checked and the unit will not accept entries that breach the 360 MW limit. This is covered in more detail in the sections that show primary voltage and current set-up. The Maximum Power restriction of 360 MW refer to 120% of nominal current and 120% of nominal voltage, i.e. 250 MW nominal system power.

1.3 Secondary Voltage

0240	0340	0440	0640	1000	1540

Most of the products described in this manual allow the user to specify, within a range, the secondary voltage of the potential transformer (PT) with which it is to be used. The exception is the Integra 1000 and self contained Integra 1540, which has the PT secondary factory set. On the Integra 1000/1540, the user cannot change this value.

1.4 Demand Calculation

0240	0340	0440	0640	1000	1540

The maximum power consumption of an installation is an important measurement, as most power utilities base their charges on it. Many utilities use a thermal maximum demand indicator (MDI) to measure this peak power consumption. An MDI averages the power consumed over a number of minutes, reflecting the thermal load that the demand places on the supply system.

The Integra uses a sliding window algorithm to simulate the characteristics of a thermal MDI instrument, with the demand being calculated once per minute.

The demand period can be reset, which allows synchronisation to other equipment. When it is reset, the values in the Demand and Maximum Demand registers are set to zero.

Demand Integration Times can be set to 8, 15, 20 or 30 minutes.

The number of sub-intervals, i.e. the demand time in minutes, can be altered either by using the Demand Integration Time set-up screen (see Section 3.8) or via the RS485 port, where available, using the Modbus™ protocol.

During the initial period, when the elapsed time since the demands were last reset or since the Integra was switched on is less than one minute, the maximum demands (current MaxAD and power MaxkWD) will remain at zero and not follow the instantaneous demands.

Maximum Demand is the maximum power or current demand that has occurred since the unit was last reset as detailed in Section 3.9 Resets.

1.5 RS485 Serial Option

0240	0340	0440	0640	1000	1540	Option

This option is available on two-part (separate transducer and display) units and on 1000 and self-contained 1540 units.

This option uses an RS485 serial port with Modbus or JC NII protocol to provide a means of remotely monitoring and controlling the Integra unit. Both protocols are supplied in the same unit. Communications automatically configure according to the protocol that is recognized when the master sends a message.

Where the installation comprises separate display and transducer units, the display communicates with the transducer using a modified Modbus protocol via the RS485 port. Such a transducer may have two such ports, either or both of which can be used for connection to a display. Where a port is available, it can be connected to a PC for control and monitoring purposes.

Set-up screens are provided for setting up the Modbus port. See Sections 3.12 to 3.14. These screens are not applicable for setting up a port connected to a display unit, as the characteristics of such a port are preset. On a two-port unit, communications settings made from an Integra display affect the other communications port, unless the second port is also connected to a display, in which case the changes have no effect.

1.6 Pulse Output Option

0240	0340	0440	0640	1000	1540	Option

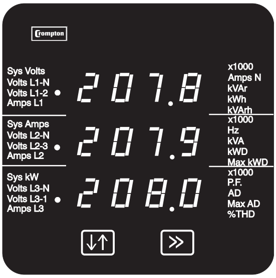
This option provides a relay pulse output indication of measured active energy (kWh). The unit can produce one pulse for every 1, 10 or 100kW of energy consumed. Two-part 1540 display units operating with 1560 or 1580 transducers can also produce a pulse for every 1000 kW of energy consumed. The pulse divisor can be set from the Set-up screen as detailed in Section 3.11 Pulse Rate. The pulse width (duration) can be set as detailed in Section 3.10 Pulsed Output, Pulse Duration. On two part units, two pulsed outputs are available with common pulse rate divisions and pulse widths.

1.7 Analogue Output Option

0240	0340	0440	0640	1000	1540	Option

This option is available on two-part (separate transducer and display) units and provides an analogue current output that indicates the value of a chosen parameter. The parameter can be chosen and set up via the set-up screen as described in Section 3.15 Analogue Output Set Up.

2 Display Screens



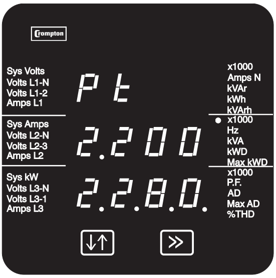
Voltage display

2.1 Layout

The screen is used in two main modes: display of measured values and parameter setup.

In display mode, three measured values can be shown, one on each row. For each row, the LED indicators show the parameter being measured and the units.

The >> button moves between display screens.

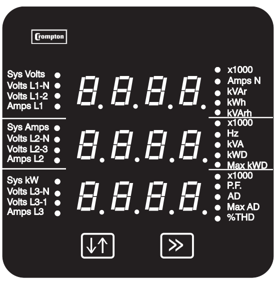


Setup confirmation screen

In Set up mode, the top row shows an abbreviation of the parameter name, the middle row shows the parameter value being set and the bottom row is used for confirmation of the entered value. In general, the ↓↑ key changes a parameter value and the >> key confirms a value and moves on to the next screen.

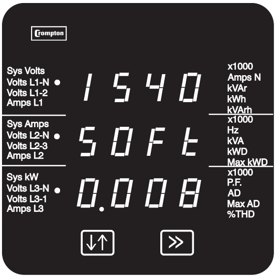
This example is the potential transformer primary voltage confirmation screen.

The example screens shown in this manual are those relating to the 1540 models – the most complex. The screens for simpler models are similar except that some of the parameters and values are omitted. Section 1.1 shows the default display screens for the various models.



2.2 Start Up Screens

Initially, when power is applied to the Integra Display, two screens will appear. The first screen lights the LED's and can be used as a display LED check.



The second screen indicates the firmware installed in the display unit. This example states that the version is 0.008. The version on a particular unit will differ in line with ongoing development and improvements.

After a short delay, the default Display screen will appear.

Use the >> (Next) key to move from one screen to the next in the sequence. The sequence depends on the supply configuration (single phase 2 or 3 wire, 3 phase 3 or 4 wire).

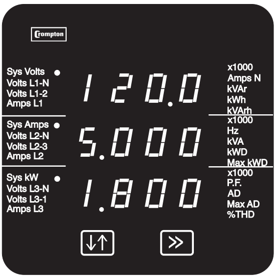
2.3 System Screen

0240	0340	0440	0640	1000	1540

The following sections show 3 and 4 wire systems.

Single phase 2 and 3 wire systems have similar display screens.

The system screen is the default display. It appears when the unit is energised after the start up screens. Section 1.1 shows the default system screens for the various models.



System Average Voltage (Volts)*

System Average Line Current (Amps).

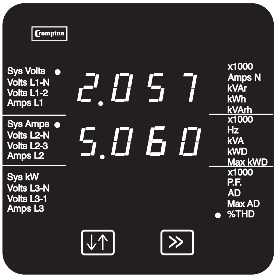
System Total Active Power (kW).

Pressing key >> moves to the next screen

* Line to Line for 3 wire systems, Line to Neutral for 4 wire and single phase 3 wire systems.

2.4 System %THD Screen

0240	0340	0440	0640	1000	1540



Average % Total Harmonic Distortion for System Voltages.

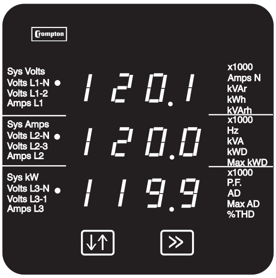
Average % Total Harmonic Distortion for System Currents.

Key >> moves to next screen.

2.5 Line to Neutral Voltages

0240	0340	0440	0640	1000	1540

Three phase, four wire systems only.



Voltage Line 1 to Neutral (Volts).

Voltage Line 2 to Neutral (Volts).

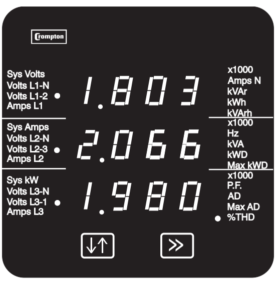
Voltage Line 3 to Neutral (Volts).

Key >> moves to next screen.

2.6 Line to Neutral Voltage %THD

0240	0340	0440	0640	1000	1540

Three-phase, four wire systems only.



%THD of Line 1 Voltage to Neutral.

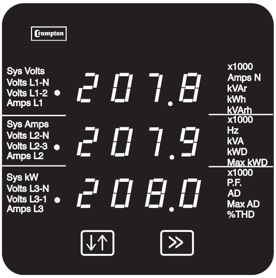
%THD of Line 2 Voltage to Neutral.

%THD of Line 3 Voltage to Neutral.

Key >> moves to next screen.

2.7 Line to Line Voltages

0240	0340	0440	0640	1000	1540



Voltage Line 1 to Line 2 (Volts).

Voltage Line 2 to Line 3 (Volts).

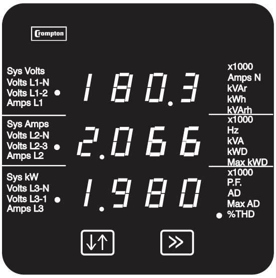
Voltage Line 3 to Line 1 (Volts).

Key >> moves to next screen.

2.8 Line to Line Voltages %THD

0240	0340	0440	0640	1000	1540

Three-phase, three wire systems only.



Line 1 to Line 2 Voltage %THD.

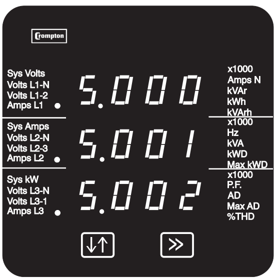
Line 2 to Line 3 Voltage %THD.

Line 3 to Line 1 Voltage %THD.

Key >> moves to next screen.

2.9 Line Currents

0240	0340	0440	0640	1000	1540



Line 1 Current (Amps).

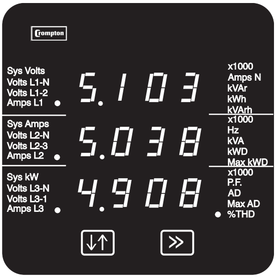
Line 2 Current (Amps).

Line 3 Current (Amps).

Key >> moves to next screen.

2.10 Line Currents %THD

0240	0340	0440	0640	1000	1540



Line 1 Current %THD.

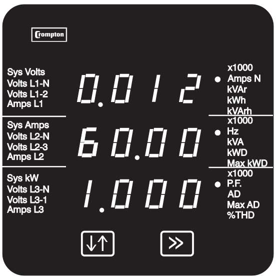
Line 2 Current %THD.

Line 3 Current %THD.

Key >> moves to next screen.

2.11 Neutral Current, Frequency and Power Factor

0240	0340	0440	0640	1000	1540



Neutral Current (Amps).
(4-wire and single phase 3 wire system only).

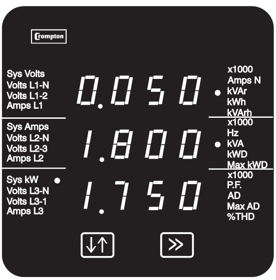
Frequency (Hz).

Power Factor (0 to 1, on 1000 and combined 1540; sign (-) prefix, on 1540 two part: prefix C indicates Capacitive load and L = Inductive).

Key >> moves to next screen.

2.12 Power

0240	0340	0440	0640	1000	1540



Reactive Power (kVAr).

Apparent Power (kVA).

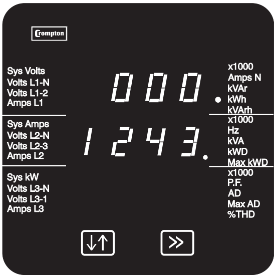
Active Power (kW).

Key >> moves to next screen.

2.13 Active Energy (kWh)

0240	0340	0440	0640	1000	1540

This is the energy that has been consumed since the unit was last reset (see Section 3.9 Resets).



Active Energy (kWh)

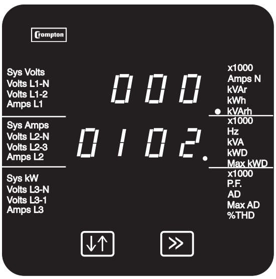
7 digit reading i.e. 0001243.

Key >> moves to next screen.

2.14 Reactive Energy (kVArh)

0240	0340	0440	0640	1000	1540

This is the reactive energy that has been consumed since the unit was last reset (see Section 3.9 Resets). The reading shows the energy (kVArh) in the reactive component of the supply.



Reactive Energy (kVArh)

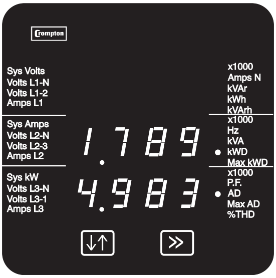
7 digit reading i.e. 0000102

Key >> moves to next screen.

2.15 Demand

0240	0340	0440	0640	1000	1540

This screen displays the present demand, i.e. the maximum power and the maximum current demanded during the defined integration window period. See Section 3.8 Demand Integration Time.



System Total Active Power Demand (kWD)

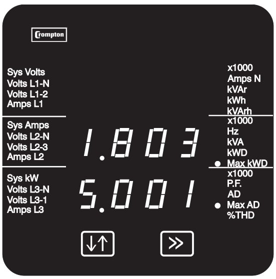
System Total Current Demand (AD)

Key >> moves to the next screen.

2.16 Maximum Demand

0240	0340	0440	0640	1000	1540

This screen displays the maximum power and the maximum current that has been demanded since the unit was last reset (see Section 3.9 Resets).



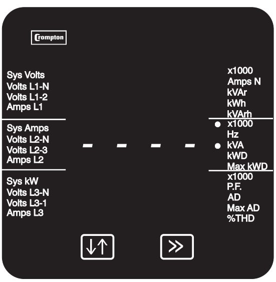
Maximum System Total Active Power Demand (kWD)

Maximum System Total current Demand (AD)

Key >> returns to the start of the sequence with the System Screen

2.17 Over Range

The displayed values must be in the range –999 x 1000 to 9999 x 1000. Any parameter value outside this range will cause the display to show overrange.



This situation will be indicated by displaying four bars in the appropriate line:

The value on the middle line is over range.

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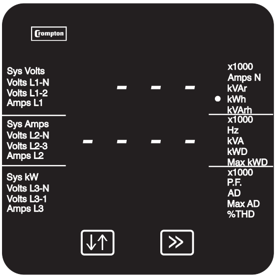
2.18 kWh and kVArh Display Range

0240	0340	0440	0640	1000	1540

The kWh and kVArh display range is limited to 9999999. If the unit is allowed to increment beyond this value the count will either wrap back to zero (if the 1560/1580 transducer is set to 7 digit mode) or continue to be updated in the 1560/1580 transducer but the display will change to seven bars. The value will continue to be available via the Modbus output.



2.19 Error Messages

The display repeatedly requests new values from the measurement processor. If there is a problem obtaining these values, the display will continue to retry but will alert the user by displaying the message Err1. This message may be seen briefly during conditions of extreme electromagnetic interference with the normal display returning once the interference has ceased.

If the Err1 message persists, try interrupting, for ten seconds, the auxiliary supply (or supplies) to the Integra (display and transducer). This may restore normal operation. Also check that auxiliary power is reaching the transducer and is within specification. Check that there are no problems with the communications cable between the display and transducer, where applicable.

3 Setting up

3.1 Introduction

The following sections give step by step procedures for configuring the Integra transducer for a particular installation using an attached display.

To access the Set-up screens, press and hold the ↓↑ (Adjust) key and the >> (Next) keys simultaneously for five seconds. This brings up the password entry stage. (See Section 3.3 Access).

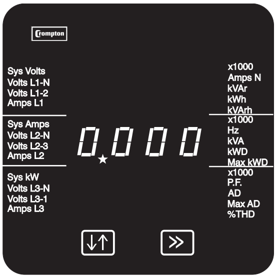
On completion of the last Set-up screen, the program exits Set-up mode and returns to the last selected Display screen. To return to the Display screens at any time during the set up procedures, press the ↓↑ and the >> keys simultaneously for five seconds.

3.2 Number Entry Procedure

When setting up the unit, many screens require the setting up of a number, usually on the middle row of digits. In particular, on entry to the setting up section, a password must be entered. The procedure is as follows:

In general, press the ↓↑ (adjust) key to change something on the current screen. Pressing the >> (next) key normally leaves the current screen unchanged and brings up the next screen.

The example below shows how the number 0000 can be changed to 1234.

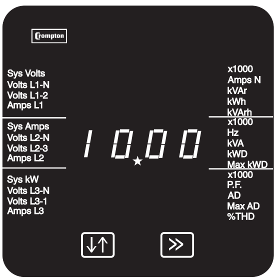


First digit

The digits are set one at a time, from left to right. The decimal point to the right of the digit (* in the picture) flashes to indicate which digit can currently be changed. It thus acts as a cursor. Where the cursor coincides with a genuine decimal point on the display, the decimal point will flash.

Press the ↓↑ key to scroll the value of the first digit from 0 through to 9, the value will wrap from 9 round to 0. For this example, set it to ‘1’.

Press the >> key to confirm your setting and advance to the next digit.



Second digit

Use the ↓↑ key to set the second digit to the required value.

Press the >> key to confirm your selection and advance to the next digit.

Third digit

Use the ↓↑ key to set the third digit to the required value.

Press the >> key to confirm your selection and advance to the next digit.

Fourth digit

Use the ↓↑ key to set the fourth digit to the required value.

Press the >> key to confirm your selection. If the unit accepts your entry, the Confirmation screen will appear.

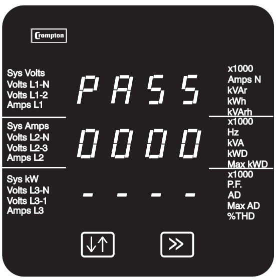
If the unit does not accept your entry, e.g. an incorrect password, a rejection screen will appear, with dashes on the bottom line.

Confirmation

The Confirmation screen shows the entered number on the bottom row with all decimal points showing.

If the displayed number is correct, press the >> key to move to the next Set-up screen.

If not, press the ↓↑ key to return to restart the number entry. The first digit entry screen will appear.



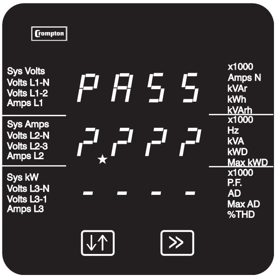
Rejection

If a rejection screen appears, press the ↓↑ key to restart the entry procedure.

3.3 Access

To access the Set-up screens, press the ↓↑ and >> keys simultaneously for five seconds, until the Password Introduction screen appears.

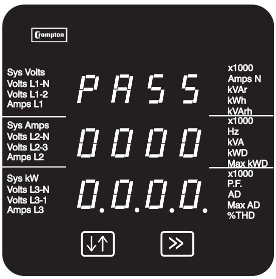
Password protection can be enabled to prevent unauthorised access to Set-up screens. Password protection is not normally enabled when a product is shipped. The unit is protected if the password is set to any four digit number other than 0000. Setting a password of 0000 disables the password protection.



Password introduction

3.3.1 Access with No Password Protection

Press >> from the Password Introduction screen. The 0000 password confirmation screen will appear.



0000 Password confirmation

Press >> again to proceed to the first Set-up screen.

Password introduction

3.3.2 Access with Password Protection

If the unit is protected by a password, proceed as follows:

First digit

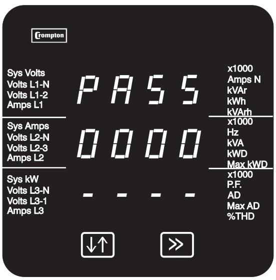
Enter the four-digit password using the method described in Section 3.2 Number Entry Procedure.

Password Confirmation

On pressing >> to confirm the last digit, the Confirmation screen will appear, provided the password is correct.

From the Password Confirmation screen, there is the option of changing the password, as described in Section 3.4 Changing the Password.

To proceed to the first Set-up screen, press >>.



Password Incorrect

If the password is incorrect, the Password Request screen will reappear to permit a retry. Press ↓↑ to start a retry or >> to exit to the Display screens.

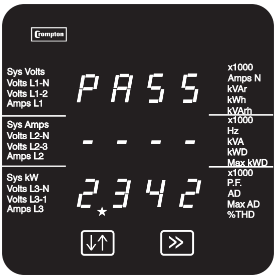
3.4 Changing the Password

The option to change the password is only available from the Password Confirmation screen immediately after the user has entered the existing password, if applicable.

Password Confirmation

Press ↓↑ to start changing the password.

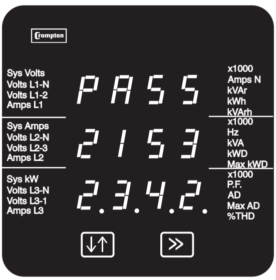
The password screen for the first digit will appear, with the old password on the bottom line.



First new password digit

Set up the new password on the bottom line, as described in Section 3.2 Number Entry Procedure.

On pressing >> to confirm the last digit, the Password Confirmation screen will appear.



New password confirmation

Press >> to confirm the new password. The first Set-up screen will appear.

Press ↓↑ to try again. The first digit screen will appear again.

3.5 Full Scale Current

0240	0340	0440	0640	1000	1540

This parameter is the value of nominal Full Scale Currents that will be displayed as the Line Currents. This screen enables the user to display the Line Currents inclusive of any transformer ratios. The values displayed represent the current in amps. For example setting 800 on this screen will cause the display to indicate 800 amps when the nominal maximum (typically 5A or factory build option of 1A) current flows through the transducer current inputs.The maximum value is as specification.

Edit

Press >> to accept the present value and move on to the next Set-up screen (Section 3.6 Potential Transformer Primary Voltage).

To change the Full Scale Current, press ↓↑ and change the current value as detailed in Section 3.2 Number Entry Procedure. If the presently displayed current, together with the full scale voltage value, results in an absolute maximum power (120% of nominal current and voltage) of greater than 360 Megawatts, the range of the most significant digit will be restricted.

The Maximum Power restriction of 360 Megawatts refers to 120% of nominal current and 120% of nominal voltage, i.e. 250 Megawatts nominal system power.

When the least significant digit has been set, pressing the >> key will advance to the Full Scale Current Confirmation stage.

The minimum value allowed is 1. The value will be forced to 1 if the display contains zero when the >> key is pressed.

3.6 Potential Transformer Primary Voltage

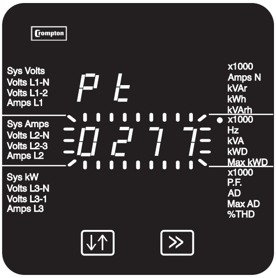
0240	0340	0440	0640	1000	1540

This value is the nominal full scale voltage which will be displayed as L1-N, L2-N and L3-N for a four wire system, L1-2, L2-3 and L3-1 in a three wire system or system volts for single phase. This screen enables the user to display the line to neutral and line to line voltages inclusive of any transformer ratios. The values displayed represent the voltage in kilovolts (note the x1000 indicator). For example, on a 2.2kV system with 110V potential transformer secondary, set 2.200 at this screen.

If there is no potential transformer (PT) in the system, i.e. the voltage terminals are connected directly to the metered voltage, leave this value unchanged and skip this set up step.

If the PT primary and secondary values are changed and it is desired to revert to a set-up with no PT, then set both PT primary and secondary values to the nominal maximum voltage for the Integra transducer.

To set up the PT primary, proceed as follows:



Decimal Point

To accept the currently displayed value, press >>. The screen will move on to the next Set-up screen (Section 3.7 Potential Transformer Secondary Value).

Press ↓↑ to change the PT Primary voltage.

Initially all the digits of the present value will be flashing and the decimal point position will be illuminated. This is to indicate that initially the 'multiplier' must be selected. Press ↓↑ to set the decimal point position.

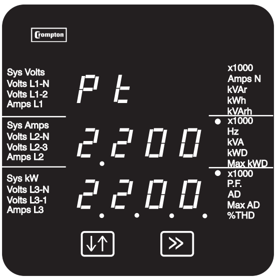
Note that the x1000 indicator is on.

Press >> to accept the displayed (decimal point position). The digits stop flashing and the PT Primary Value screen appears

Digit Edit

Set the display to read the value of the PT Primary voltage, using the method described in Section 3.2 Number Entry Procedure. The primary voltage that can be set will be restricted to a value such that, together with the full scale current value (previously set), the absolute maximum power (120% of nominal current and voltage) cannot exceed 360 Megawatts.

After the last digit has been accepted, the Confirmation screen will appear.



Confirmation

This example confirmation screen shows a primary voltage setting of 2.2 kV.

Press >> to accept the displayed PT Primary Voltage. The next Set-up screen will appear (Section 3.7 Potential Transformer Secondary Value).

To change the displayed value, press ↓↑. The Decimal Point screen will reappear.

3.7 Potential Transformer Secondary Value

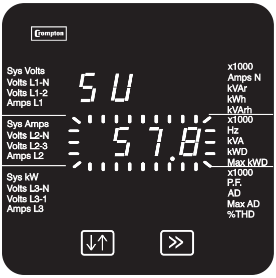
0240	0340	0440	0640	1000	1540

In Model 1000 and 1540 combined, the PT Secondary Value is factory set, as marked on the barrel. The PT Secondary Value is user programmable on the 1540 and Integra 1560 two part.

This value must be set to the nominal full scale secondary voltage which will be obtained from the transformer when the potential transformer (PT) primary is supplied with the voltage defined in Section 3.6 Potential Transformer Primary Voltage. This defines the actual full scale voltage that will be obtained from the PT secondary and measured by the unit. The ratio of the full scale primary to full scale secondary voltage is the transformer ratio. Given full scale primary and secondary voltages, the unit knows what primary voltage to display for any given measured secondary voltage.

The secondary voltage displayed is in volts. Following the previous example, on a 2.2 kV system with 110V PT secondary, set this screen to 110.0.

If there is no PT associated with this unit, leave this value unchanged and skip this step.



Decimal Point

To accept the displayed PT Secondary Voltage, press >>. The next Set-up screen will appear (Section 3.8 Demand Integration Time).

To change the PT Secondary Voltage display, press ↓↑.

Note that the decimal point edit screen will only appear when the display unit is connected to a transducer designed for connection to voltages in the range 57.7 to 139V.

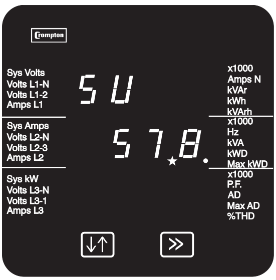
Initially all the digits of the present value will be flashing and the decimal point position will be illuminated. This is to indicate that initially the 'multiplier' must be selected.

Press ↓↑ to change the decimal point position.

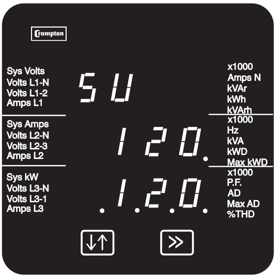
Press >> to accept the decimal point position. The Digit Edit screen appears.

Set the display to read the value of the PT Secondary voltage, as described in Section 3.2 Number Entry Procedure.

After the last digit has been set and accepted, the Confirmation screen will appear.



Digit Edit



Confirmation

Press >> to accept the displayed value. Depending on the model, this may take you out of the Set-up screens and back to the last selected Display screen.

Press ↓↑ to return to the Decimal Point screen.

The secondary value may only be set to values within the range defined by the factory voltage build option. These nominal rms input voltages are as shown in the relevant measurement transducer specification (see separate document for two-part products or Section 4.2.1 Inputs for combined products).

3.8 Demand Integration Time

0240	0340	0440	0640	1000	1540

This screen is used to set the period over which current and power readings are integrated (see Section 1.4 Demand). The value displayed represents time in minutes.

Value

To accept the displayed Demand Integration Time, press >>. The next Set-up screen will appear (Section 3.9 Resets)

To change the Demand Integration Time, press ↓↑ and use this key to scroll through the available values.

Select the required value and press >> to accept it. The Confirmation screen will appear.

Confirmation

Press >> to accept the displayed value . The next Set-up screen will appear (Section 3.9 Resets).

Press ↓↑ to return to the Value screen and change the value.

3.9 Resets

0240	0340	0440	0640	1000	1540

The following screens allow resetting of the Energy and Demand readings individually or altogether.

Resetting the cumulative Energy (h) resets both Active and Reactive Energy.

Resetting Demand (d) resets:

- Active Power Demand
- Current Demand
- Maximum Active Power Demand
- Maximum Current Demand

Reset (None)

Press >> to move on to the next Set-up screen without resetting any readings.

To reset one or more readings press ↓↑. The first reset screen (All) will appear.

Reset All

Use ↓↑ to scroll through the parameters that can be reset:

h Active and reactive energy

d Demands and maximum demands

None – no reset

All – h and d combined.

Select the option required and press >> to confirm your selection. The appropriate confirmation screen will appear.

(The confirmation screen will not appear if None has been selected.)

Confirmation

Press ↓↑ to return to the Reset screen.

Press >> to reset the selected reading(s). The next screen will appear.

3.10 Pulsed Output, Pulse Duration

0240	0340	0440	0640	1000	1540	Option

This applies to the Relay Pulsed Output option only. Units with this option provide pulses to indicate power consumption (kWh). See Section 1.6 pulse output option.

This screen allows the user to set the duration of the relay output pulse. The value displayed represents the pulse duration in milliseconds (ms). On a two part DIS 1540/Integra 1560, this screen will set the pulse duration for the Kvarh pulse relay (where fitted) also.

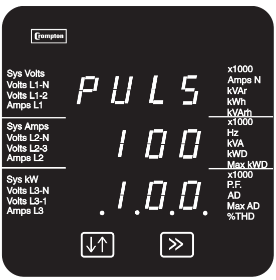
Edit

To retain the current setting, press >>. The next Set-up screen will appear.

To change the pulse duration, press ↓↑.

Use the ↓↑ key to scroll through the available values of 60, 100 and 200.

Select the value required and press >> to confirm your selection. The confirmation screen will appear.



Confirmation

To change the value again, press ↓↑. The Edit screen will reappear.

To accept the displayed pulse duration, press >>. The next screen will appear. Depending on the model, this may take you out of the Set-up screens and back to the last selected Display screen.

3.11 Pulse Rate

0240	0340	0440	0640	1000	1540	Option

This applies to the Relay Pulsed Output option only. Units with this option provide pulses to indicate power consumption (kWh).

This screen allows setting of the kWh pulse rate divisor. On a two part DIS 1540/Integra 1560, this screen will set the pulse rate for the kvarh pulse relay (where fitted) also. By default, the unit produces one pulse per kWh. Changing this divisor changes the output pulse rate, as follows:

Divisor	**One pulse per:**
1	1 kWh
10	10 kWh
100	100 kWh
1000	1000 kWh (DIS1540 with 1560/1580 only)

Press >> to accept the currently displayed value. The next Set-up screen will then appear.

Edit

To change the pulse rate divisor, press ↓↑.

Use the ↓↑ key to scroll the value through the available values 1, 10, 100, 1,000. If the maximum power is greater than 3.6 megawatts, the range of divisors will be restricted to force an upper limit to the number of pulses/hour of 3600.

Select the required divisor and press >> to confirm your selection. The Confirmation screen will appear.

To change the value again, press ↓↑. The Edit screen will reappear.

To accept the displayed value, press >>. The next Set-up screen will appear.

Confirmation

3.12 RS485 Baud Rate

0240	0340	0440	0640	1000	1540	Option

Use this screen to set the Baud Rate of the RS485 Modbus/JC NII port. The values displayed are in kbaud.

Where the transducer unit may be separate from the display unit, the transducer has two Modbus ports, at least one of which may be used for communicating with a display. The RS485 Baud Rate option only sets the Baud Rate for a port that is not communicating with a display unit. The port characteristics for communication with a display are preset. If the JC NII protocol is to be used, the baud rate must be set to 9.6.

If a display is detected on an RS485 port at start-up, any user settings for that port will be ignored.

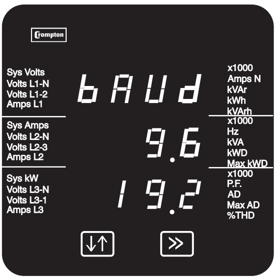
Edit

Press >> to accept the currently displayed value. The next Set-up screen will then appear.

To change the baud rate, press ↓↑.

Use the ↓↑ key to scroll through the available values 2.4, 4.8, 9.6 and 19.2.

Select the required baud rate and press >> to confirm your selection. The Confirmation screen will appear.



Confirmation

Press >> to accept the new setting. The next Set-up screen will appear.

To change the value again, press ↓↑. The Edit screen will reappear.

3.13 RS485 Parity Selection

0240	0340	0440	0640	1000	1540	Option

This screen allows setting of the parity and number of stop bits of the RS485 Modbus/JC II port.

Where the transducer unit is separate from the display unit, the transducer has two Modbus ports, one of which may be used for communicating with a display. The RS485 Parity Selection option only sets the parity for a port that is not communicating with a display unit. The port characteristics for communication with a display are preset.

If the JC NII protocol is to be used, this parameter must be set to No parity and One stop bit.

Edit

Press >> to accept the currently displayed value. The next Set-up screen will then appear.

To change the parity press ↓↑.

Use the ↓↑ key to scroll through the available values:

odd – odd parity with one stop bit

E – even parity with one stop bit

no 1 – no parity one stop bit,

no 2 – no parity two stop bits.

Select the required setting and press >> to confirm your selection. The Confirmation screen will appear.

Confirmation

Press >> to accept the new setting. The next Set-up screen will appear.

Press ↓↑ to return to the Edit screen.

3.14 RS485 Modbus Address

0240	0340	0440	0640	1000	1540	Option

This screen allows setting of the Modbus/JC NII device address for the instrument.

Where the transducer unit is separate from the display unit, the transducer has two RS485 ports, one of which may be used for communicating with a display. The Address option only sets the address for a port that is not communicating with a display unit. The port characteristics for communication with a display are preset.

Edit

Press >> to accept the currently displayed value. The next Set-up screen will then appear.

To change the address, press ↓↑.

Set the three-digit address using the method described in Section 3.2 Number Entry Procedure. The range of the allowable addresses is 1 to 247. The range of selectable digits is restricted so that no higher number can be set.

Press >> to confirm your selection. The Confirmation screen will appear.

Confirmation

If the new address is correct, press >>. Depending on the model, this may take you out of the Set-up screens and back to the last selected Display screen.

If the new address is not correct, press ↓↑ to return to the Edit screen.

3.15 Analogue Output Set Up

0240	0340	0440	0640	1000	1540	Option

This is an option on Models 1540 that have separate (1560 or 1580) transducers.

3.15.1 Introduction

This applies to the analogue output option only, allowing the parameter to be selected, and the upper and lower limits adjusted, for either one or two channels.

For each analogue output fitted, provision is made for five values to be user selected. These are:

- **A1r** – Parameter, from Table 2. This is the measured input that is to be represented by the analogue output, for example, Watts or Frequency.
- **A1rt** – Reading Top. This is the value of the electrical parameter that will cause the analogue output to produce 'Output Top'.
- **A1rb** – Reading Bottom. This is the value of the electrical parameter that will cause the analogue output to produce 'Output Bottom'.
- **A1ot** – Output Top. This is the value of output that will be reached when the measured electrical parameter is at the reading top value.
- **A1ob** – Output Bottom. This is the value of output that will be reached when the measured electrical parameter is at the reading bottom value.

To aid understanding, a simple example is shown in Section 3.15.2.

3.15.1.1 Second Channel

The screens following show the set-up for the first analogue channel. Set-up of the second analogue output is identical except that screens show 'A2' instead of 'A1', i.e. **A2r, A2rt, A2rb, A2ot, A2ob**.

At the end of the set up for the second analogue output pressing >> will exit the set up system and enter the display mode.

3.15.1.2 Reverse Operation

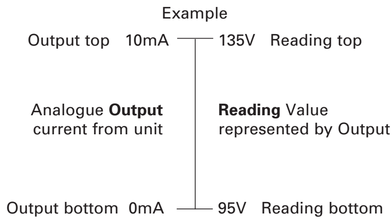
It is possible to set reading top below reading bottom. In the example of Section 3.15.2, setting reading top to 95 volts and reading bottom to 135 volts would cause the output current to decrease from 20mA to 4mA as the measured voltage increased from 95 to 135 volts.

3.15.1.3 Reduced output range

Note that if the output values are adjusted to reduce output range, accuracy may be degraded. For example, if a 0-20mA capable output is set to operate over 0-1mA, then the specified accuracy will be degraded by a factor of 20.

3.15.2 Analogue Output Scaling Example

In this example, the Integra has an output current range of 0 to 10mA and it is required that this output range represents a reading range of 95 to 135V.



3.15.2.1 Reading (A1r or A2r)

The measured electrical parameter that the analogue output will represent.
Example: **Volts Ave** (Average Voltage)

As shown in Table 2, any continuously variable parameter (volts, amps, watts etc) can be selected for output as an analogue value. The table also shows those values that may be signed (where the value may go negative).

3.15.2.2 Reading Top (A1rt or A2rt)

This is the value of the electrical parameter that will cause the analogue output to produce ‘Output Top’.

Example: **135 volts**.

3.15.2.3 Reading Bottom (A1rb or A2rb)

This is the value of the electrical parameter that will cause the analogue output to produce ‘Output Bottom’.

Example: **95 volts**.

This value may be set to any value between zero and 120% of nominal. (Or between –120% and +120% of values that may be signed for example VAr)

3.15.2.4 Output

The two Output values specify the analogue current outputs that will represent the top and bottom Reading values. They are included to allow additional versatility where particular requirements prevail or to convert a 0-20mA output to 4-20mA. However it is suggested that, in most other cases, these values should be set to the limits that the hardware can cover. The range of the analogue output(s) for the unit is marked on the product label.

3.15.2.5 Output Top (A1ot or A2ot)

This is the value of output that will be reached when the measured electrical parameter is at the reading top value.

Example: **10mA**.

3.15.2.6 Output Bottom (A1ob or A2ob)

This is the value of output that will be reached when the measured electrical parameter is at the reading bottom value.

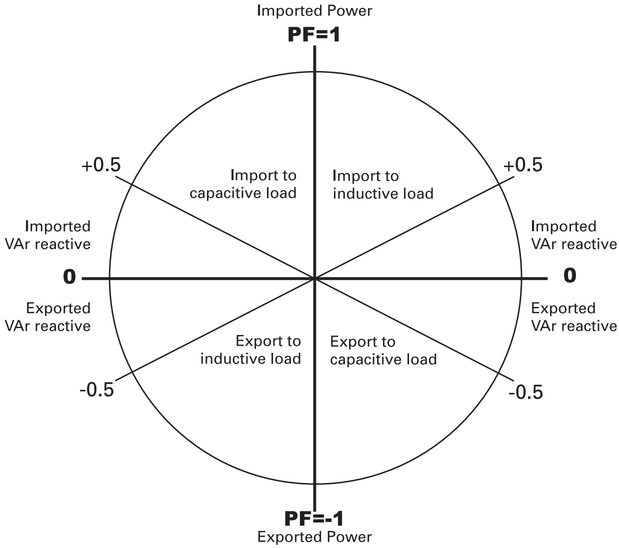
Example: **0mA**

3.15.2.7 Summary

In the above example, the analogue output will be 0 mA when the average voltage is 95 volts, 5 mA at 115 volts and 10 mA at 135 volts.

3.15.3 Power Factor

When analogue output current is used to represent power factor, it can indicate the power factor for an inductive or capacitive load on imported or exported power. This can be shown in two dimensions as follows:



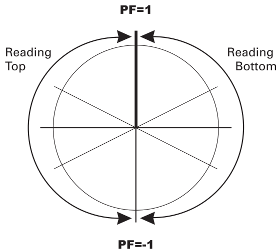
Power factor

The polarity of the power factor reading indicates the direction of power flow:

Positive	PF relates to imported power
Negative	PF relates exported power.

This assumes that the unit is connected for a predominantly ‘import’ application. See Installation sheet for further details.

When setting up the analogue output for a power factor reading, the Reading Top value must be in one of the left-hand quadrants and the Reading Bottom value must be in one of the right-hand quadrants.

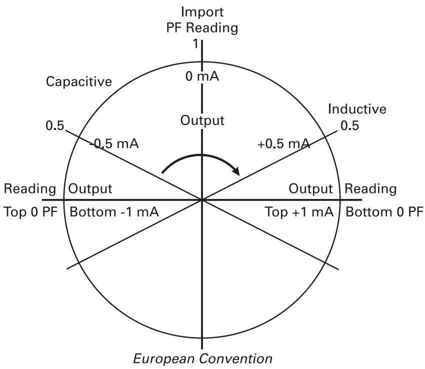


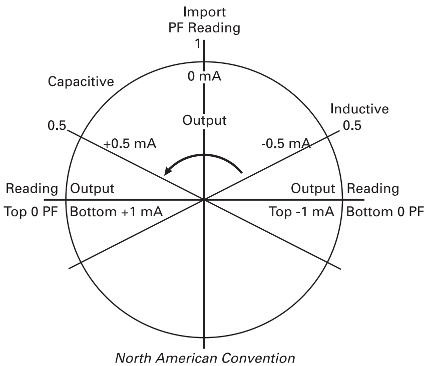
Hence, if the Reading Top value is set to –0.5, this will be a power factor of 0.5 for power exported to an **inductive** load (bottom **left-hand** quadrant). Conversely, the Reading Bottom value must be in one of the two right-hand quadrants. If the Reading Bottom value is set to –0.5, this will be a power factor of 0.5 for power exported to a capacitive load (bottom **right-hand** quadrant). Thus a power factor of +1 (for true power imported to a resistive load) is always included in the analogue output range.

In specifying the Output Top and Output Bottom values, there are two conventions – one for European areas of influence and one for North American areas. The two conventions are:

Europe	Output Top greater or more positive than Output Bottom.
USA	Output Top less or more negative than Output Bottom.

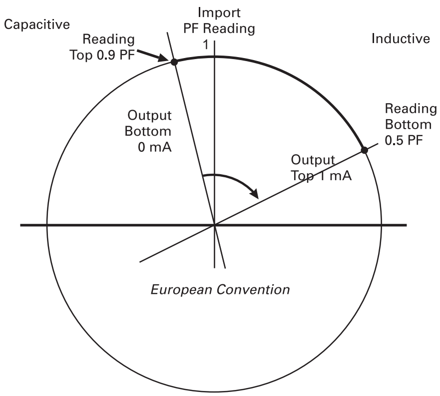
The examples below show cases where power is only imported and the load may be either capacitive or inductive. The Reading Top and Reading Bottom values of zero ensure that the whole range of possible (import) power factor readings is covered. The unit in the left-hand example has an analogue output range of +1 to –1 mA and, since the Output Top value (+1 mA) is more positive than the Output Bottom value (-1 mA), this arrangement complies with the European convention. The right-hand example shows the North American convention.

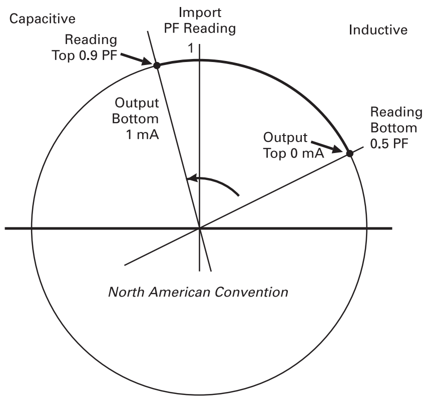




Symmetrical full-range, import only

In the above symmetrical arrangement, 0 mA corresponds to unity power factor. This is not the case with the following asymmetrical arrangement.

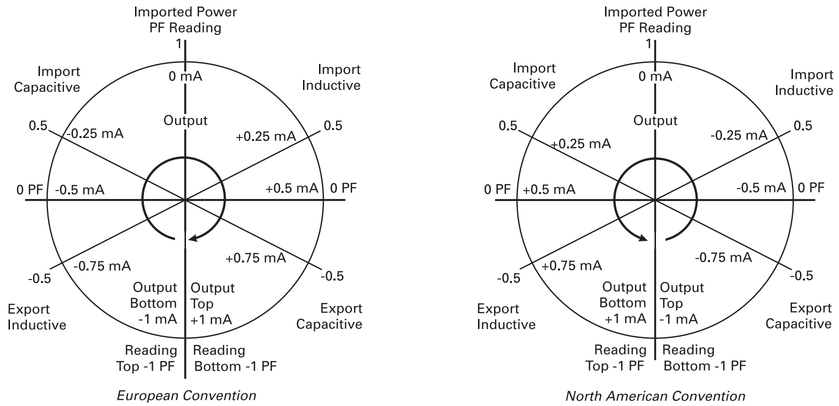




Asymmetrical, import only, mainly inductive

In the example above, the unit has an analogue output range of 0 to 1 mA, all power is imported and the load is inductive. The 1 mA Output range covers a reading power factor range of 0.6, from 0.9 capacitive to 0.5 inductive. The capacitive overlap is provided in case of over-compensation of power factor. The Output to Reading correlation is as follows:

Reading	**European Convention Output**	**North American Convention Output**
0.9 PF cap.	0 mA	1 mA
1 PF	0.167 mA	0.833 mA
0.9 PF ind.	0.333 mA	0.667 mA
0.8 PF ind.	0.500 mA	0.500 mA
0.7 PF ind.	0.667 mA	0.333 mA
0.6 PF ind.	0.833 mA	0.167 mA
0.5 PF ind.	1 mA	0 mA

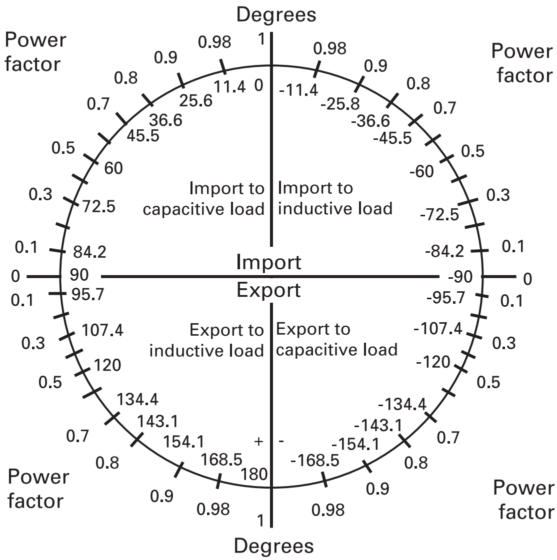


Symmetrical full-range import/export

In this example, the unit is set to represent the full range of inductive and capacitive loads on imported and exported power. The unit has an analogue output range of –1 to +1 mA. Both Reading Top and Reading Bottom are set to –1 power factor.

3.15.4 Phase Angle

The Phase Angle analogue outputs are treated in a similar manner to Power Factor, with values specified in degrees. The following figure shows the relationship between phase angle in degrees and power factor.



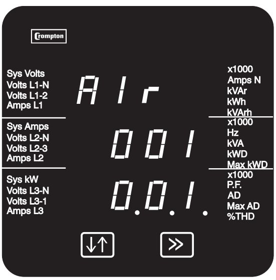
3.15.5 Parameters available for analogue outputs

Table 2 Analogue output parameter selection

Parameter Number	Parameter	3 Ø 4 wire	3 Ø 3 wire	1 Ø 3 wire	1 Ø 2 wire	+/-
1	Volts 1 (L1 – N 4W or L1 – L2 3W)	✓	✓	✓	✓	
2	Volts 2 (L2 – N 4W or L2 – L3 3W)	✓	✓	✓		
3	Volts 3 (L3 – N 4W or L3 – L1 3W)	✓	✓			
4	Current 1	✓	✓	✓	✓	
5	Current 2	✓	✓	✓		
6	Current 3	✓	✓			
7	Watts Phase 1	✓		✓	✓	✓
8	Watts Phase 2	✓		✓		✓
9	Watts Phase 3	✓				✓
10	VA Phase 1	✓		✓	✓	
11	VA Phase 2	✓		✓		
12	VA Phase 3	✓				
13	VAr Phase 1	✓		✓	✓	✓
14	VAr Phase 2	✓		✓		✓
15	VAr Phase 3	✓				✓
16	Power Factor Phase 1	✓		✓	✓	✓
17	Power Factor Phase 2	✓		✓		✓
18	Power Factor Phase 3	✓				✓
19	Phase Angle Phase 1	✓		✓	✓	✓
20	Phase Angle Phase 2	✓		✓		✓
21	Phase Angle Phase 3	✓				✓
22	Volts Ave	✓	✓	✓	✓	
24	Current Ave	✓	✓	✓	✓	
25	Current Sum	✓	✓	✓	✓	
27	Watts Sum	✓	✓	✓	✓	✓
29	VA Sum	✓	✓	✓	✓	
31	VAr Sum	✓	✓	✓	✓	✓
32	Power Factor Ave	✓	✓	✓	✓	✓
34	Average Phase Angle	✓	✓	✓	✓	✓
36	Frequency	✓	✓	✓	✓	
43	W Demand Import	✓	✓	✓	✓	
44	W Max. Demand Import	✓	✓	✓	✓	
53	A Demand	✓	✓	✓	✓	
54	A Max. Demand	✓	✓	✓	✓	
101	V L1-L2 (calculated)	✓		✓		
102	V L2-L3 (calculated)	✓				

Parameter Number	Parameter	3 Ø 4 wire	3 Ø 3 wire	1 Ø 3 wire	1 Ø 2 wire	+/-
103	V L3-L1 (calculated)	✓				
104	Average Line to Line Volts	✓		✓		
113	Neutral Current	✓		✓	✓	
118	THD Volts 1	✓	✓	✓	✓	
119	THD Volts 2	✓	✓	✓		
120	THD Volts 3	✓	✓			
121	THD Current 1	✓	✓	✓	✓	
122	THD Current 2	✓	✓	✓		
123	THD Current 3	✓	✓			
125	THD Voltage Mean	✓	✓	✓	✓	
126	THD Current Mean	✓	✓	✓	✓	

Parameter Selection



Confirmation

3.15.6 Reading (Parameter Selection) - A1r or A2r

Use this screen to choose the parameter that the analogue Output current will represent. The number displayed on the screen is the Parameter Number shown in Table 2.

If the displayed Parameter Number is already correct, press >> to move on to the next Set-up screen.

To change the Parameter Number, press ↓↑ and set the three-digit number using the method described in Section 3.2 Number Entry Procedure.

Press >> to confirm your selection. The Confirmation screen will appear.

If the new Parameter Number is correct, press >>. The next Set-up screen will appear.

If not, press ↓↑. You will be returned to the Parameter Selection screen.

3.15.7 Reading Top – A1rt or A2rt

The top reading is limited to 120% of the nominal maximum value of the parameter. For example, a 230V nominal can be adjusted from 0 to 276V. The minimum is zero or –120% if the parameter is signed.

Sign edit

This screen allows a negative value to be specified as the top reading. It will only be available if the parameter selected on the previous screen can be negative. For these parameters, the +/- column of Table 2 has a tick (✓).

To accept the current value ('-' for negative, no symbol for positive), press >> to advance to the Alrb screen.

Use ↓↑ to select the '-' sign for a negative Reading or no symbol for a positive Reading.

Press >> to accept the current sign and advance to the next screen.

Decimal Point Position

Use this screen to set the position of the decimal point. This screen will not appear when the selected parameter is frequency, as there is no choice of decimal point position.

Pressing the ↓↑ key will advance the decimal point position to the right, illuminating the x1000 indicator as necessary and wrapping the decimal point position when the highest available position for the currently selected reading has been exceeded. (Maximum resolution is 3 digits of the metered value.)

Select the required decimal point position and press >> to confirm your selection. The next screen will appear.

Value Entry

Use this screen to set the value of the Reading Top

Set the three-digit Reading Top value using the method described in Section 3.2 Number Entry Procedure.

Press >> to confirm your selection. The Confirmation screen will appear.

Confirmation

Press >> to accept the displayed Reading Top value, The next Set-up screen will appear.

Press ↓↑ to return to the Edit screen.

3.15.8 Reading Bottom - A1rb or A2rb

Use these screens to specify the minimum or most negative value for the Reading Bottom value.

The method of setting the Reading Bottom screens is the same as for setting the Reading Top screens, as described in Section 3.15.7. The Reading Bottom screens show A1rb (or A2rb for the Analogue output 2) on the top line.

3.15.9 Output Top – A1ot or A2ot

Use these screens to set the maximum analogue output current (in mA). This current will represent the highest reading value. You cannot specify a greater current than the actual value that the unit can supply, e.g. 1 mA.

The method of setting the Output Top screens is the same as for setting the Reading Top screens, as described in Section 3.15.7. The Output Top screens show A1ot (or A2ot for the Analogue output 2) on the top line.

3.15.10 Output Bottom – A1ob or A2ob

Use these screens to set the minimum or most negative analogue output current (in mA). This current will represent the lowest or most negative reading value. The current cannot be set to a value that exceeds the actual capability of the unit, e.g. it cannot be set it to –10 mA if the unit can only handle –1 mA.

The method of setting the Output Bottom screens is the same as for setting the Reading Top screens, as described in Section 3.15.7. These screens show A1ob (or A2ob for Analogue output 2) on the top line.

4 Specification

The parameters listed in this section apply only to those models that can measure those parameters.

4.1 Display Only Versions

4.1.1 Input

RS485	Dedicated to Crompton Integra transducers

4.1.2 Auxiliary Power Supply

The unit can be powered from an auxiliary a.c. or d.c. supply that is separate from the metered supply. Versions of the unit are available to suit 100-250V 45-65 Hz a.c./d.c. and 12-48V d.c supplies.

4.1.2.1 High Voltage version

Standard nominal supply voltages	100 - 250V a.c. nominal ± 15% (85V a.c. absolute minimum to 287V a.c. absolute maximum) or 100 - 250V d.c. nominal -15%, +25% (85V d.c. absolute minimum to 312V d.c. absolute maximum)
A.C. supply frequency range	45 to 66 Hz or 360 to 440 Hz (Model 0440)
A.C. supply burden	4VA approx.

4.1.2.2 Low Voltage version

D.C.supply	12 - 48V d.c. -15% + 25% (10.2V d.c. absolute minimum to 60V d.c. absolute maximum)
D.C. supply burden	4VA approx.

4.1.3 EMC Standards

EMC Immunity	EN61326 for Industrial Locations to performance criterion A
EMC Emissions	EN61326 to Class A - Industrial

4.1.4 Safety

IEC1010-1 (BSEN 61010-1) Permanently connected use, Normal Condition Installation category III, pollution degree 2, Basic Insulation 300V RMS maximum. Auxilary circuits (12-48V auxiliary, communications, relay and analogue outputs, where applicable) are separated from metering inputs and 100-250V auxiliary circuits by at least basic insulation. Such auxiliary circuit terminals are only suitable for connection to equipment which has no user accessible live parts. The insulation for such auxiliary circuits must be rated for the highest voltage connected to the instrument and suitable for single fault condition. The connection at the remote end of such auxiliary circuits should not be accessible in normal use. Depending on application, equipment connected to auxiliary circuits may vary widely. The choice of connected equipment or combination of equipment should not diminish the level of user protection specified.

4.1.5 Insulation

Dielectric voltage withstand test	3.25kV RMS 50 Hz for 1 minute between all electrical circuits

4.1.6 Environmental

Operating temperature	-10 to +60°C
Storage temperature	-20 to +85°C
Relative humidity	0 .. 95% non condensing
Shock	30g in 3 planes
Vibration	10 to 15 Hz @ 1.5 mm peak-peak 15 to 150 Hz @ 1.0g
Enclosure integrity (front face only)	IP54

4.1.7 Enclosure

Style	ANSI C39.1
Material	Polycarbonate front and base, steel case
Terminals	Screw clamp style

4.2 Display/Transducer Combined 0240, 0340, 0440, 0640

For Model 1000 and 1540 specification, refer to Section 4.3.

4.2.1 Inputs

Three phase three wire voltage range:	ELV	100 - 120V L-L
	LOV	121 - 240V L-L
	MIV	241 - 480V L-L
	HIV	481 - 600V L-L
Three phase four wire voltage range:	ELV	100 - 120V L-L (57.7 - 70V L-N)

	LOV	121 - 240V L-L (70.1 - 139V L-N)
	MIV	241 - 480V L-L (140 - 277V L-N)
	HIV	481 - 600V L-L (277 - 346V L-N)

(Voltage range is defined by factory build option.)

Nominal input voltage (a.c. rms)	57.7 to 346V L-N 100 to 600V L-L
System PT/VT primary values	1V to 400 kV
Max continuous input voltage	120% of nominal (up to 720 V max.)
Max short duration input voltage	Twice nominal (1s application repeated 10 times at 10s intervals)
Nominal input voltage burden	0.2 VA approx. per phase
Nominal input current	1 or 5 A a.c. rms
System CT primary values	Standard values up to 9999 Amps (5 A secondaries) (1 A on application)
Max continuous input current	120% of nominal
Max short duration current input	20 times nominal (1s application repeated 5 times at 5 min intervals)
Nominal input current burden	0.6 VA approx. per phase

4.2.2 Auxiliary Power Supply

The unit can be powered from an auxiliary a.c. or d.c. supply that is separate from the metered supply. Versions of the unit are available to suit 100-200V 45-65 Hz a.c./d.c. and 12-48V d.c supplies.

4.2.2.1 High Voltage version

Standard supply voltage	100 to 250V a.c. nominal ±15% (85V a.c. absolute minimum to 287V a.c. absolute maximum) or 100V to 250V d.c. nominal +25%, -15% (85V d.c. absolute minimum to 312V d.c. absolute maximum)
a.c. supply frequency range	45 to 66 Hz or 360 to 440 Hz (Model 0440)
a.c. supply burden	3W

4.2.2.2 Low Voltage version

d.c.supply	12 to 48V d.c.. nominal +25%, -15% (10.2V d.c. absolute minimum to 60V d.c. absolute maximum)
d.c. supply burden	3W

4.2.3 Measuring Ranges

Values of measured quantities for which errors are defined.

Voltage	70 .. 120% of nominal
Current	5 .. 120% of nominal
Frequency	45 .. 66 Hz, 360 .. 440 Hz (Model 0440) Crest values of voltage and current must remain within 168% of nominal maximum rms values

4.2.4 Accuracy

Voltage	0.4% of reading ±0.1% of range 1% of range maximum for Model 0440
Current	0.4% of reading ±0.1% of range 1% of range maximum for Model 0440
Frequency (not 0340)	0.15% of mid frequency 1% of mid frequency for Model 0440
Temperature coefficient	0.013%/°C typical
Response time to step input	1.5 seconds approx.
Screen update time	0.5 second approx.

4.2.5 Reference conditions of influence quantities

Values that quantities which affect measurement errors to a minor degree have to be for the intrinsic (headline) errors for measured quantities to apply.

Ambient temperature	23°C
Input frequency	50 or 60 Hz 2%
Input waveform Sinusoidal	(distortion factor 0.005)
Auxiliary supply voltage Nominal	1%
Auxiliary supply frequency Nominal	1%
Auxiliary supply distortion factor	0.05
Magnetic field of external origin	Terrestrial flux

4.2.6 EMC Standards

EMC Immunity EN61326 for Industrial Locations to performance criterion A

EMC Emissions EN61326 to Class B - Domestic

4.2.7 Safety

IEC1010-1 (BSEN 61010-1) Permanently connected use, Normal Condition Installation category III, pollution degree 2, Basic Insulation 720V RMS maximum. Auxiliary circuits (12-48V auxuliary, communications, relay and analogue outputs, where applicable) are separated from metering inputs and 100-250V auxiliary circuits by at least basic insulation. Such auxiliary circuit terminals are only suitable for connection to equipment which has no user accessible live parts. The insulation for such auxiliary circuits must be rated for the highest voltage connected to the instrument and suitable for single fault condition. The connection at the remote end of such auxiliary circuits should not be accessible in normal use. Depending on application, equipment connected to auxiliary circuits may vary widely. The choice of connected equipment or combination of equipment should not diminish the level of user protection specified.

4.2.8 Insulation

Dielectric voltage withstand test 3.25kV RMS 50Hz for 1 minute between all isolated electrical circuits

4.2.9 Environmental

Operating temperature	-20 to +70°C
Storage temperature	-20 to +80°C
Relative humidity	0 .. 95% non condensing
Shock	30g in 3 planes
Vibration	10 to 15 Hz @ 1.5 mm peak-peak 15 to 150 Hz @ 1.0g
Enclosure integrity (front face only)	IP54
Harmonic distortion	max 50% THD up to 15th harmonic

4.2.10 Enclosure

Style	ANSI C39.1
Material	Polycarbonate front and base, steel case
Terminals	6-32 UNC slotted barrier type
Weight	1.3kg

4.3 Display/Tranducer Combined 1000 and 1540

See section 4.3.16 for specifications particular to the 1540

4.3.1 Inputs

Nominal input voltage (a.c. rms)	57.7 to 600V L-N (single phase) 100 to 600V L-L (3 wire) 57.7 to 346V L-N (4 wire)
System PT/VT primary values	1V to 400KV

Max continuous input voltage	120% of nominal (up to 720V max.)
Max short duration input voltage	2*nominal (1s application repeated 10 times at 10s intervals)
Nominal input voltage burden	0.2VA approx. per phase
Nominal input current	1 or 5A a.c. rms
System CT primary values	Std. values up to 4kA (1 or 5 Amp secondaries)
Max continuous input current	120% of nominal
Max short duration current input	20*nominal (1s application repeated 5 times at 5 min intervals)
Nominal input current burden	0.6VA approx. per phase

4.3.2 Auxiliary Power Supply

The unit can be powered from an auxiliary a.c. or d.c. supply that is separate from the metered supply. Versions of the unit are available to suit 100-200V 45-65 Hz a.c./d.c. and 12-48V d.c supplies.

Standard supply voltage	100 to 250V a.c. nominal ±15% (85V a.c. absolute minimum to 287V a.c. absolute maximum) or 100V to 250V d.c. nominal +25%, -15% (85V d.c. absolute minimum to 312V d.c. absolute maximum)
a.c. supply frequency range	45 to 66 Hz or 360 to 440 Hz (Model 0440)
a.c. supply burden	3W
d.c.supply	12 to 48V d.c.. nominal +25%, -15% (10.2V d.c. absolute minimum to 60V d.c. absolute maximum)
d.c. supply burden	3W

4.3.3 Accuracy

Voltage	0.4% of reading ±0.1% of range
Current	0.4% of reading ±0.1% of range
Neutral current	4% of range
Frequency	0.15% of mid frequency
Power factor	1% of Unity
Active power (W)	0.9% of reading ±0.1% of range
Reactive power (VAr)	1.9% of reading ±0.1% of range
Apparent power (VA)	0.9% of reading ±0.1% of range
Active energy (W.h)	1 Class (IEC 1036, Active PF 0.8-1-0.8 importing)
Reactive energy (VAr.h)	2%, Reactive PF 0.8-1-0.8 importing)
Temperature coefficient	0.013%/°C typical
Response time to step input	1.5 seconds approx.
Error change due to variation of an influence quantity in the manner described in section 6	Twice the error allowed for the reference condition applied in the test.

of IEC688:1992

Error in measurement when a measurand is within its measuring range, but outside its reference range.	Twice the error allowed at the end of the reference range adjacent to the section of the measuring range where the measurand is currently operating or being tested.

4.3.4 Reference conditions

Reference conditions of measurands and, where applicable, components of the measurand

Values of measured quantities, and of components of measured quantities, where the intrinsic (headline) errors for the measured quantities apply.

Voltage	50 .. 100% of nominal
Current	10 .. 100% of nominal
Frequency	Nominal ±10%
Active power (Watt)	10 .. 100% of nominal
Voltage	Nominal ±2%
Current	10 .. 100% of nominal
Active power factor	1 .. 0.8 leading or lagging
Reactive power (VAr)	10 .. 100% of nominal
Voltage	Nominal ±2%
Current	10 .. 100% of nominal
Reactive power factor	1 .. 0.8 leading or lagging
Apparent Power (VA)	10 .. 100% of nominal
Voltage	Nominal ±2%
Current	10 .. 100% of nominal
Power factor	1 .. 0.8 leading or lagging
Voltage	Nominal ±2%
Current	40 .. 100% of nominal

4.3.5 Reference conditions of influence quantities

Values that quantities which affect measurement errors to a minor degree have to be for the intrinsic (headline) errors for measured quantities to apply.

Ambient temperature	23°C
Input frequency	50 or 60 Hz ±2%
Input waveform	Sinusoidal (distortion factor 0.005)
Auxiliary supply voltage	Nominal ±1%
Auxiliary supply frequency	Nominal ±1%
Auxiliary supply distortion factor	0.05
Magnetic field of external origin	Terrestrial flux

4.3.6 Nominal range of use of influence quantities for measurands

Values of quantities which affect measurement errors to a minor degree for which the magnitude of the measurement error is defined in this specification.

Voltage	50 .. 120% of nominal
Current	5 .. 120% of nominal
Frequency	Nominal ±10%
Power factor (active/reactive as appropriate)	0.5 lagging .. 1 .. 0.8 leading ,importing
Temperature	-20°C to +70°C
Input waveform distortion	20% 3rd Harmonic distortion
Auxiliary supply voltage	Nominal ±10%
Auxiliary supply frequency	Nominal ±10%
Magnetic field of external origin	400A/m
	Crest values of voltage and current must remain within 168% of nominal maximum rms values

4.3.7 Functional ranges

The functional ranges of measurands and of influence quantities for measurands

Values of measured quantities, components of measured quantities, and quantities which affect measurement errors to a minor degree, for which the product gives meaningful readings.

Voltage	5 .. 120% of nominal (below 5% of nominal voltage, current indication is only approximate)
Current	0 .. 120% of nominal (2 .. 120% of nominal for Power Factor)
Frequency	45 .. 66 Hz
Power Factor	1 .. 0 leading or lagging, importing (active/reactive as appropriate)
Temperature	-20°C to +70°C
Active power (Watt)	0 .. 120% of nominal, 360 MW Max.
Reactive power (VAr)	0 .. 120% of nominal, 360 MVAr Max.
Apparent power (VA)	0 .. 120% of nominal, 360 MVA Max.

4.3.8 Screen

Update	0.5 second approx.

4.3.9 Standards

Terms, Definitions and Test Methods	IEC688 (BSEN 60688) IEC1036 (BSEN 61036)
EMC	IEC 61326

4.3.10 Safety

IEC1010-1 (BSEN 61010-1) Permanently connected use, Normal Condition Installation category III, pollution degree 2, Basic Insulation 720V RMS maximum. Auxiliary circuits (12-48V auxuliary, communications, relay and analogue outputs, where applicable) are separated from metering inputs and 100-250V auxiliary circuits by at least basic insulation. Such auxiliary circuit terminals are only suitable for connection to equipment which has no user accessible live parts. The insulation for such auxiliary circuits must be rated for the highest voltage connected to the instrument and suitable for single fault condition. The connection at the remote end of such auxiliary circuits should not be accessible in normal use. Depending on application, equipment connected to auxiliary circuits may vary widely. The choice of connected equipment or combination of equipment should not diminish the level of user protection specified.

4.3.11 Insulation

Dielectric voltage withstand test 3.25kV RMS 50Hz for 1 minute between all isolated electrical circuits

4.3.12 Environmental

Operating temperature	-20°C to +70°C
Storage temperature	-20°C to +80°C
Relative humidity	0 .. 95% non condensing
Warm up time	1 minute
Shock	30g in 3 planes
Vibration	10 to 15 Hz @ 1.5 mm peak-peak 15 to 150 Hz @ 1.0g
Enclosure code (front)	IP54
Harmonic distortion	max 50% THD up to 15th harmonic

4.3.13 Enclosure

Style	ANSI C39.1 or JIS C-1102
Material	Polycarbonate Front, Steel case
Terminals	6-32 UNC slotted barrier style.
Weight	1.3kg

4.3.14 Serial Communications Option

Protocol	MODBUS (RS485)
Baud rate	19200, 9600, 4800 or 2400 (programmable)
Parity	Odd or Even, with 1 stop bit, or None with 1 or 2 stop bits.

4.3.15 Active Energy Pulsed Output Option

Rated	SPNO, 100V dc, 0.5A Max.
Default pulse rate	1 per kWhr
Pulse rate divisors	1 10 (yielding 1 pulse per 10 kWhr) 100 (yielding 1 pulse per 100 kWhr)
Pulse duration	60ms, 100ms or 200ms, 3600 Pulses per hour max

4.3.16 Integra 1540 Only

Measuring Range: Total Harmonic Distortion:	Up to 15th Harmonic 0%-50%
Accuracy:	Total Harmonic Distortion 1%
Reference conditions of measurands:	Voltage: 60% to 100% of nominal for THD
Reference conditions of measurands:	Total Harmonic Distortion: 20% to 100% of nominal for THD
Reference conditions of measurands:	Total Harmonic Distortion: 0-30%

5 Basis of measurement and calculations

Reactive and Apparent Power

Active powers are calculated directly by multiplication of voltage and current. Reactive powers are calculated using frequency corrected quarter phase time delay method. Apparent power is calculated as the square root of sum of squares of active and reactive powers. For 4 wire products, overall powers are the sum of the per phase powers. For 3 phase 3 wire products, the "two wattmeter" method is used for overall powers.

Energy resolution

Cumulative energy counts are reported using the standard IEEE floating point format. Reported energy values in excess of 16MWh may show a small non cumulative error due to the limitations of the number format. Internally the count is maintained with greater precision. The reporting error is less than 1 part per million and will be automatically corrected when the count increases.

Power Factor

The magnitude of Per Phase Power Factor is derived from the per phase active power and per phase apparent power. The power factor value sign is set to negative for an inductive load and positive for a capacitive load.

The magnitude of the System Power Factor is derived from the sum of the per phase active power and per phase apparent power. The system power factor value sign is set to negative for an inductive load and positive for a capacitive load. The load type, capacitive or inductive, is determined from the signs of the sums of the relevant active powers and reactive powers. If both signs are the same, then the load is inductive, if the signs are different then the load is capacitive.

The magnitude of the phase angle is the ArcCos of the power factor. It's sign is taken as the opposite of the var's sign.

Maximum Demand

The maximum power consumption of an installation is an important measurement as power utilities often levy related charges. Many utilities use a thermal maximum demand indicator (MDI) to measure this peak power consumption. An MDI averages the power consumed over a number of minutes, such that short surges do not give an artificially high reading.

Integra uses a sliding window algorithm to simulate the characteristics of a thermal MDI instrument, with the demand period being updated every minute.

The demand period can be reset, which allows synchronisation to other equipment. When it is reset, the values in the Demand and Maximum Demand registers are set to zero.

Time Integration Periods can be set to 8, 15, 20 or 30 minutes.

Note: During the initial period when the "sliding window" does not yet contain a full set of readings (i.e. the elapsed time since the demands were last reset or the elapsed time since Integra was switched on is less than the selected demand period) then maximum demands may not be true due to the absence of immediate historical data.

The Time Integration Period can be user set either from the Integra 1540 Display or by using the communications option.

Total Harmonic Distortion (1540 only)

The calculation used for the Total Harmonic Distortion is:

THD = ((RMS of total waveform - RMS of fundamental) / RMS of total waveform) x 100

This is often referred to as THD - R

The figure is limited to the range 0 to 100% and is subject to the 'range of use' limits. The instrument may give erratic or incorrect readings where the THD is very high and the fundamental is essentially suppressed.

For low signal levels the noise contributions from the signal may represent a significant portion of the "RMS of total waveform" and may thus generate unexpectedly high values of THD. To avoid indicating large figures of THD for low signal levels the product will produce a display of 0 (zero).

Typically, display of THD will only produce the 0 (zero) value when the THD calculation has been suppressed due to a low signal level being detected. It should also be noted that spurious signals (for example, switching spikes) if coincident with the waveform sampling period will be included in the "RMS of the total waveform" and will be used in the calculation of THD.

The display of THD may be seen to fluctuate under these conditions.

6 Serial Communications

6.1. RS485 Port – Modbus or JC N2

0240	0340	0440	0640	1000	1540	Option

INTEGRA 1000 and 1540 offer the option of an RS485 communication port for direct connection to SCADA systems. This port can be used for either an RS485 Modbus RTU slave, or as a Johnson Controls N2 protocol slave. Choice of reply protocol is made by the Integra on the basis of the format of request, so that a Modbus request receives a Modbus reply, and an N2 protocol request receives an N2 protocol reply.

6.2 Modbus® Implementation

This section provides basic information for the integration of the product to a Modbus network. If background information or more details of the Integra implementation is required please refer to our "Guide to RS485 Communications and the Modbus Protocol", available on our CD catalogue or from any recognised supplier.

The Modbus, protocol establishes the format for the master's query by placing into it the device address, a function code defining the requested action, any data to be sent, and an error checking field. The slave's response message is also constructed using Modbus protocol. It contains fields confirming the action taken, any data to be returned, and an error-checking field. If an error occurs in receipt of the message, or if the slave is unable to perform the requested action, the slave will construct an error message and send it as it's response. Framing errors receive no response from the Integra.

The electrical interface is 2-wire RS485, via 3 screw terminals. Connection should be made using twisted pair screened cable (Typically 22 gauge Belden 8761 or equivalent). All "A" and "B" connections are daisy chained together. The screens should also be connected to the "Gnd" terminal. To avoid the possibility of loop currents, an Earth connection should be made at only one point on the network.

Line topology may or may not require terminating loads depending on the type and length of cable used. Loop (ring) topology does not require any termination load.

The impedance of the termination load should match the impedance of the cable and be at both ends of the line. The cable should be terminated at each end with a 120 ohm (0.25 Watt min.) resistor.

A total maximum length of 3900 feet (1200 metres) is allowed for the RS485 network. A maximum of 32 electrical nodes can be connected, including the controller.

The address of each Integra 1000/1540 can be set to any value between 1 and 247. Broadcast mode (address 0) is not supported.

The maximum latency time of an Integra 1000/1540 is 150ms i.e. this is the amount of time that can pass before the first response character is output. The supervisory programme must allow this period of time to elapse before assuming that the Integra is not going to respond.

The data format in RTU mode is:

Coding System:	8-bit per byte
Data Format:	4 bytes (2 registers) per parameter. Floating point format (to IEEE 754) Most significant register first (Default). The default may be changed if required - See Holding Register "Register Order" parameter.
Error Check Field:	2 byte Cyclical Redundancy Check (CRC)
Framing:	1 start bit 8 data bits, least significant bit sent first 1 bit for even/odd parity or no parity 1 stop bit if parity is used; 1 or 2 bits if no parity

Data Transmission speed is selectable between 2400, 4800, 9600 and 19200 baud.

Input Registers

Input registers are used to indicate the present values of the measured and calculated electrical quantities.

Each parameter is held in two consecutive 16 bit registers. The following table details the 3X register address, and the values of the address bytes within the message. A tick (÷) in the column indicates that the parameter is valid for the particular wiring system. Any parameter with a cross (X) will return the value Zero (0000h). Some parameters are only available on the Integra 1540, as shown in the table below..

Each parameter is held in the 3X registers. Modbus Function Code 04 is used to access all parameters.

e.g. to request	Volts 1	Start address	= 00
	No of registers		= 02
	Volts 2	Start address	= 02
	No of registers		= 02

Each request for data must be restricted to 40 parameters or less. Exceeding the 40 parameter limit will cause a Modbus exception code to be returned.

Register	Parameter Number	Parameter	Modbus Start Address Hex		3 Ø 4 wire	3 Ø 3 wire	1 Ø 3 wire	1 Ø 2 wire
			High Byte	Low Byte				
30001	1	Volts 1 (L1 – N 4W or L1 – L2 3W)	00	00	✓	✓	✓	✓
30003	2	Volts 2 (L2 – N 4W or L2 – L3 3W)	00	02	✓	✓	✓	X
30005	3	Volts 3 (L3 – N 4W or L3 – L1 3W)	00	04	✓	✓	X	X
30007	4	Current 1	00	06	✓	✓	✓	✓
30009	5	Current 2	00	08	✓	✓	✓	X
30011	6	Current 3	00	0A	✓	✓	X	X
30013	7	Watts Phase 1 - Integra 1540 only	00	0C	✓	X	✓	✓
30015	8	Watts Phase 2 - Integra 1540 only	00	0E	✓	X	✓	X
30017	9	Watts Phase 3 - Integra 1540 only	00	10	✓	X	X	X
30019	10	VA Phase 1 - Integra 1540 only	00	12	✓	X	✓	✓
30021	11	VA Phase 2 - Integra 1540 only	00	14	✓	X	✓	X
30023	12	VA Phase 3 - Integra 1540 only	00	16	✓	X	X	X
30025	13	var Phase 1 - Integra 1540 only	00	18	✓	X	✓	✓
30027	14	var Phase 2 - Integra 1540 only	00	1A	✓	X	✓	X
30029	15	var Phase 3 - Integra 1540 only	00	1C	✓	X	X	X
30031	16	Power Factor Phase 1 - Integra 1540 only	00	1E	✓	X	✓	✓
30033	17	Power Factor Phase 2 - Integra 1540 only	00	20	✓	X	✓	X
30035	18	Power Factor Phase 3 - Integra 1540 only	00	22	✓	X	X	X
30037	19	Phase Angle Phase 1 - Integra 1540 only	00	24	✓	X	✓	✓
30039	20	Phase Angle Phase 2 - Integra 1540 only	00	26	✓	X	✓	X
30041	21	Phase Angle Phase 3 - Integra 1540 only	00	28	✓	X	X	X
30043	22	Volts Ave	00	2A	✓	✓	✓	✓
30047	24	Current Ave	00	2E	✓	✓	✓	✓
30049	25	Current Sum - Integra 1540 only	00	30	✓	✓	✓	✓
30053	27	Watts Sum	00	34	✓	✓	✓	✓
30057	29	VA Sum	00	38	✓	✓	✓	✓
30061	31	var Sum	00	3C	✓	✓	✓	✓
30063	32	Power Factor Ave	00	3E	✓	✓	✓	✓
30067	34	Average Phase Angle - Integra 1540 only	00	42	✓	✓	✓	✓
30071	36	Frequency	00	46	✓	✓	✓	✓
30073	37	Wh Import	00	48	✓	✓	✓	✓
30077	39	varh Import	00	4C	✓	✓	✓	✓
30085	43	W Demand Import	00	54	✓	✓	✓	✓
30087	44	W Max. Demand Import	00	56	✓	✓	✓	✓
30105	53	A Demand	00	68	✓	✓	✓	✓
30107	54	A Max. Demand	00	6A	✓	✓	✓	✓
30201	101	V L1-L2 (calculated)	00	C8	✓	X	✓	X
30203	102	V L2-L3 (calculated)	00	CA	✓	X	X	X
30205	103	V L3-L1 (calculated)	00	CC	✓	X	X	X
30207	104	Average Line to Line Volts	00	CE	✓	X	✓	X
30225	113	Neutral Current	00	E0	✓	X	✓	✓
30235	118	THD Volts 1 - Integra 1540 only	00	EA	✓	✓	✓	✓
30237	119	THD Volts 2 - Integra 1540 only	00	EC	✓	✓	✓	X
30239	120	THD Volts 3 - Integra 1540 only	00	EE	✓	✓	X	X
30241	121	THD Current 1 - Integra 1540 only	00	F0	✓	✓	✓	✓
30243	122	THD Current 2 - Integra 1540 only	00	F2	✓	✓	✓	X
30245	123	THD Current 3 - Integra 1540 only	00	F4	✓	✓	X	X
30249	125	THD Voltage Mean - Integra 1540 only	00	F8	✓	✓	✓	✓
30251	126	THD Current Mean - Integra 1540 only	00	FA	✓	✓	✓	✓
30255	128	Power Factor (+Ind/-Cap)	00	FE	✓	✓	✓	✓

Modbus Holding Registers and Integra set up

Holding registers are used to store and display instrument configuration settings. All holding registers not listed in the table below should be considered as reserved for manufacturer use and no attempt should be made to modify their values.

The demand parameters may be viewed or changed using the Modbus protocol. Each parameter is held in the 4X registers. Modbus Function Code 03 is used to read the parameter and Function Code 16 is used to write.

Register	Parameter	Parameter Number	Modbus Start Address Hex		Valid range	Mode
			High Byte	Low Byte		
40001	1	Demand Time	00	00	0 only	r/w
40003	2	Demand Period	00	02	8,15,20,30 minutes.	r/w
40007	4	System Voltage	00	06	1V - 400kV	r/wp
40009	5	System Current	00	08	1-9999 A	r/wp
40011	6	System Type	00	0A		ro
40013	7	Relay Pulse Width	00	0C	3,5,10 (x20mS)	r/w
40015	8	Energy Reset	00	0E	0 only	wo
40023	12	Pulse Divisor	00	16	1,10,100,1000	r/w
40025	13	Password	00	18	0000-9999	r/w
40037	19	System Power	00	24		r/o
40041	21	Register Order	00	28	2141.0 only	wo
40299	150	Secondary Volts	01	2A	Min Vin-Max Vin	r/wp

r/w = read/write r/wp = read and write with password clearance ro = read only wo = write only

Password Settings marked r/wp require the instrument password to have been entered into the Password register before changes will be accepted. Once the instrument configuration has been modified, the password should be written to the password register again to protect the configuration from unauthorised or accidental change. Power cycling also restores protection. Reading the Password register returns 1 if the instrument is unprotected and 0 if it is protected from changes.

Demand Time is used to reset the demand period. A value of zero must be written to this register to accomplish this. Writing any other value will cause an error to be returned. Reading this register after instrument restart or resetting demand period gives the number of minutes of demand data up to a maximum of the demand period setting. For example, with 15 minute demand period, from reset the value will increment from zero every minute until it reaches 15. It will remain at this value until a subsequent reset occurs.

Demand Period The value written must be one of the following 8,15, 20 or 30 (minutes), otherwise an error will be returned.

System Type The System type address will display '1' for single phase 2 wire, '2' for 3 Phase 3 Wire, '3' for 3 Phase 4 Wire or 4 for single phase 3 wire.

Relay Pulse Width is the width of the relay pulse in multiples of 20 ms. However, only values of 3 (60 ms), 5 (100 ms) or 10 (200 ms) are supported. Writing any other value will cause an error to be returned.

Reset Energy is used to reset the Energy readings. A value of zero must be written to this register to accomplish this. Writing any other value will cause an error to be returned.

Pulse Rate Divisor, supports only values of 1,10,100 or 1000. Writing any other value will cause an error to be returned.

System Power, is the maximum system power based on the values of system type, system volts and system current.

Register Order, the instrument can receive or send floating-point numbers in normal or reversed register order. In normal mode, the two registers that make up a floating point number are sent most significant bytes first. In reversed register mode, the two registers that make up a floating point number are sent least significant bytes first. To set the mode, write the value '2141.0' into this register - the instrument will detect the order used to send this value and set that order for all Modbus transactions involving floating point numbers.

Secondary Volts indicates the voltage on the VT secondary when the voltage on the Primary is equal to the value of System Volts . The value of this register can be set to between the minimum and maximum instrument input voltage.

6.3 RS485 Implementation of Johnson Controls Metasys

These notes explain Metasys and Crompton Instruments Integra 1000/1540 integration. Use these notes with the Metasys Technical Manual, which provides information on installing and commissioning Metasys N2 Vendor devices.

Application details

The Integra 1000/1540 is a N2 Vendor device that connects directly with the Metasys N2 Bus. This implementation assigns 33 key electrical parameters to ADF points, each with override capability.

Components requirements

- Integra 1000/1540 with RS485 option.
- N2 Bus cable.

Metasys release requirements

- Metasys OWS software release 7.0 or higher.
- Metasys NCM311. NCM360.

Support for Metasys Integration

Johnson Control Systems
System House, Randalls Research Park,
Randalls Way, Leatherhead,
Surrey, KT22 7TS
England

Support for Crompton Integra operation

This is available via local sales and service centre.

Design considerations

When integrating the Crompton equipment into a Metasys Network, keep the following considerations in mind.

- Make sure all Crompton equipment is set up, started and running properly before attempting to integrate with the Metasys Network.
- A maximum of 32 devices can be connected to any one NCM N2 Bus.

Vendor Address	1-247 (Limited by co-resident Modbus protocol)
Port Set-up	
Baud Rate	9600
Duplex	Full
Word Length	8
Stop Bits	1
Parity	None
Interface	RS485

METASYS N2 application

Integra 1560/1580 Point Mapping table

Address	Parameter Description	Units
1	Voltage 1	Volts
2	Voltage 2	Volts
3	Voltage 3	Volts
4	Current 1	Amps
5	Current 2	Amps
6	Current 3	Amps
7	Voltage average	Volts
8	Current average	Amps
9	Power (Watts) Sum	kW
10	VA Sum	kVA
11	var Sum	kvar
12	Power Factor average	
13	Frequency	Hz
14	Active Energy (Import)	kWh
15	Reactive Energy (Import)	kvarh
16	Watts Demand (Import)	kW
17	Maximum Watts Demand (Import)	kW
18	Amps Demand	Amps
19	Maximum Amps Demand	Amps
20	Voltage L1-L2 (calculated)	Volts
21	Voltage L2-L3 (calculated)	Volts
22	Voltage L3-L1 (calculated)	Volts
23	Neutral Current	Amps
24	Active Energy (Import)	GWh
25	Reactive Energy (Import)	Gvarh

The following parameters are available only on the Integra 1540

26	THD V1	%
27	THD V2	%
28	THD V3	%
29	THD I1	%
30	THD I2	%
31	THD I3	%
32	THD Vmean	%
33	THD Imean	%

7 Maintenance

Warning

- **During normal operation, voltages hazardous to life may be present at some of the terminals of this unit. Installation and servicing should be performed only by qualified, properly trained personnel' abiding by local regulations. Ensure all supplies are de-energised before attempting connection or other procedures.**

- **It is recommended adjustments be made with the supplies de-energised, but if this is not possible, then extreme caution should be exercised.**

- **Terminals should not be user accessible after installation and external installation provisions must be sufficient to prevent hazards under fault conditions.**

- **This unit is not intended to function as part of a system providing the sole means of fault protection - good engineering practice dictates that any critical function be protected by at least two independent and diverse means.**

In normal use, little maintenance is needed. As appropriate for service conditions, isolate electrical power, inspect the unit and remove any dust or other foreign material present. Periodically check all connections for freedom from corrosion and screw tightness, particularly if vibration is present.

The front of the case should be wiped with a dry cloth only. Use minimal pressure, especially over the viewing window area. If necessary wipe the rear case with a dry cloth. If a cleaning agent is necessary, isopropyl alcohol is the only recommended agent and should be used sparingly. Water should not be used. If the rear case exterior or terminals should accidentally be contaminated with water, the unit must be thoroughly dried before further service. Should it be suspected that water might have entered the unit, factory inspection and refurbishment is recommended.

In the unlikely event of a repair being necessary, it is recommended that the unit be returned to the factory or nearest Crompton service centre.

tyco
Electronics
Energy Division

Tyco Electronics UK Limited
Crompton Instruments
Freebournes Road, Witham,
Essex, CM8 3AH, UK

Tel.: +44 1376 509 509
Fax: +44 1376 509 511

DECLARATION OF CONFORMITY

Manufacturer's Name: Tyco Electronics UK Limited - Crompton Instruments
Manufacturer's Address: Freebournes Road, Witham, Essex, CM8 3AH, UK

declares that the products:
Product Names: Integra 1540 series Multifunction Digital Metering System
Model Numbers: INT-0240, INT-0340, INT-0440, INT-0640, INT-0740, INT-1540

conforms to the following standards:

LVD:
BS EN 61010-1 : 1993 Plus Amendment 2 (July 1995)
Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use

EMC:

BS EN 61326: 1998A1 Emissions standard for Measurement Control and Laboratory Equipment, Class B

BS EN 61326: 1998A1 Immunity standard for Measurement Control and Laboratory Equipment, Annex A

Supplementary Information:
The product complies with the requirements of the following EU directives and carries CE marking accordingly

- **European Low Voltage Directive 73/23/EEC** amended by **93/69/EEC** by the standards route to compliance.
- **EMC Directive 89/336/EEC**, amended by **93/68/EEC**, by the standards route to compliance.

Signature of authorised person.

N F Dudley
R&D Manager

Dated: 27 March 2003

Crompton INSTRUMENTS

FM 21540

Registered Office: Faraday Road, Dorcan, Swindon, Wiltshire, SN3 5HH, UK
Registered No. 550926
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DECLARATION OF CONFORMITY

Manufacturer's Name: Tyco Electronics UK Limited - Crompton Instruments
Manufacturer's Address: Freebournes Road, Witham, Essex, CM8 3AH, UK

declares that the products:
Product Names: Integra 1560 Transducer and display
Model Numbers: INT-1561, INT-1562, INT-1563, INT-1564, INT-1581, INT-1582, INT1583, INT-1584, DIS-0240, DIS-0340, DIS-0640, DIS-0740, DIS-1540

conforms to the following standards:

LVD:
BS EN 61010-1 : 1993 Plus Amendment 2 (July 1995)
Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use

EMC:

BS EN 61326: 1998A1 Emissions standard for Measurement Control and Laboratory Equipment, Class A

BS EN 61326: 1998A1 Immunity standard for Measurement Control and Laboratory Equipment, Annex A

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Signature of authorised person.

N F Dudley
R&D Manager

Dated: 30 April 2002

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REGISTERED FM 21540

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Notes

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